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DEPARTMENT OF PUBLIC WORKS

BALTIMORE INTEGRATED PLANNING FRAMEWORK

AFFORDABILITY ANALYSIS

October 21, 2015

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MWH-LBWS JOINT VENTURE

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1 INTRODUCTION

In July 2015, the Baltimore City Department of Public Works ("the City" of "Baltimore City") requested permission from the U.S. Environmental Protection Agency Region 3 ("EPA") and the Maryland Department of the Environment ("MDE") to complete construction on the last of its sanitary sewer overflow ("SSO") Consent Decree capital projects by January 1, 2032 followed by an 18-month post-construction flow monitoring period and submission of a "close-out" report by January 2034. One of the justifications for this request is the financial burden of the Consent Decree on the citizens of Baltimore City. According to the City's projections, extending the end of the Consent Decree to 2034 will still result in 40 percent[1] of the City's population having water, sewer and stormwater bills that they are unable to afford. The current unaffordability, as illustrated in Figure 7.5, Percentage of Households with High Financial Burden 2016 and 2034, is 22 percent. Further, future operation and maintenance ("O&M") costs associated with the new Capital Improvement Program ("CIP") projects will result in an even higher percentage of the City's population being unable to afford their bills.

In the past, a permittee's financial capability to afford proposed wastewater programs was expressed as a low, medium or high burden under the EPA's 1997 *CSO Guidance for Financial Capability Assessment and Schedule Development* (the 1997 Guidance")[2]. After several years of discussion with municipalities and industry groups, EPA issued the *Integrated Municipal Stormwater and Wastewater Planning Approach Framework*[3] in June 2012 and the *Financial Capability Assessment Framework for Municipal Clean Water Act Requirements*, dated November 24, 2014 (the "FCA Framework")[4]. This Integrated Planning Framework ("IPF") encourages permittees to examine their Clean Water Act ("CWA") obligations holistically and prioritize them to deliver the greatest environmental, social and public health benefits while acknowledging the limits of affordability.

Baltimore City faces a considerable challenge in constructing and maintaining its critical infrastructure. In future years, the City must:

- Meet the requirements of its Consent Decree;
- Complete enhanced nutrient removal upgrades to two wastewater treatment plants;
- Maintain compliance of the water system with the Safe Drinking Water Act ("SDWA"); and
- Initiate stormwater improvements to comply with the City's Municipal Separate Storm Sewer System ("MS4") permit.

Each of these challenges must be accomplished while continuing to address the general decline of the City's aging infrastructure.

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1 Revising the City's Integrated Planning model to account for a 2021 end date for Phase I of the Consent Decree results in a lower affordability figure than was previously presented.

2 U.S. Environmental Protection Agency, Office of Water. March 1997. *CSO Guidance for Financial Capability Assessment and Schedule Development*, EPA 832-B-97-004.

3 U.S. Environmental Protection Agency. June 5, 2012. *Integrated Municipal Stormwater and Wastewater Planning Approach Framework.*

4 U.S. Environmental Protection Agency, K. Kopocis and C. Giles. November 24, 2014. *Memorandum: Financial Capability Assessment Framework for Municipal Clean Water Act Requirements*.

Baltimore City has utilized the EPA's IPF guidance to create an Integrated Plan that efficiently balances the wastewater, stormwater and drinking water spending required to meet its challenges and improve all three aging systems. The capital and maintenance projects called for in the Integrated Plan are vital to protect public health and the City's environment by protecting the City's water supply, improving both water and wastewater treatment effectiveness and proactively addressing infrastructure repair and rehabilitation needs. In addition, the Integrated Plan front-loads the most beneficial projects. For example, if drinking water projects, such as the proposed and much-needed Fullerton Water Filtration Plant, were delayed in favor of completing wastewater projects faster and ending the Consent Decree sooner, there would be negative public health consequences. Similarly, moving wastewater projects earlier in the schedule without delaying water or stormwater projects, in addition to creating severe constructability challenges, would force the City to raise rates more drastically than predicted and worsen affordability outcomes.

The City has conducted a Financial Capability Analysis ("FCA") in accordance with the 1997 Guidance. The results of the FCA are presented in Section 2, EPA's 1997 Financial Capability Assessment. In the FCA Framework, EPA confirmed the flexibility inherent in the 1997 Guidance and encouraged permittees "to submit additional information that would create a more accurate and complete picture of their financial capability". Such "additional information" is presented in Sections 3 through 7, in this Affordability Analysis.

As documented in subsequent sections, the City has used the FCA Framework to determine the affordability outcomes of its Integrated Plan. This Affordability Analysis focuses on Baltimore City's income distribution which is skewed disproportionately lower than corresponding national averages and not represented accurately by the City's median household income ("MHI"). The income distribution skew is seen in the fact that the City's percentage of low-income households is twice the national average and the percentage of its higher-income households is half the national average. These low-income households represent the most economically stressed populations who are the most impacted by affordability considerations, but the least served by applying city-wide metrics to fairly calculate those impacts.

The City's Integrated Plan proposes an end Consent Decree date that is reasonable, is consistent with wise planning and EPA's IPF guidance and, although still resulting in a high financial burden for approximately 98,000 households and over 40 percent of the City's population, is less unaffordable than meeting current Consent Decree schedule mandates.

2 EPA'S 1997 FINANCIAL CAPABILITY ASSESSMENT GUIDANCE

EPA has long recognized the financial limitations of communities to implement large capital programs for wastewater. As described in this section, determinations of affordability for communities' spending on wastewater programs is based on the 1997 Guidance[5].

The 1997 Guidance assesses a community's financial capability using a two phase process. Phase 1 estimates the present value of proposed capital and operational costs of SSO controls and wastewater collection and treatment improvements, coupled with the cost of existing wastewater collection and treatment systems. The residential share of these costs is measured against median household income. This computation determines the "Residential Indicator." If the Residential Indicator is equal to or greater than 1 percent of median household income ("MHI"), the second phase is completed.

Phase 2 uses six parameters to assess a community's underlying financial capacity (the "Permittee Financial Capability Indicators"). Two of these financial capability indicators address existing debt, two concern socio-economic conditions and two evaluate property tax data. These six parameters are compared with benchmark figures (for example, nationwide data) or against specific criteria provided by EPA. The Residential Indicator is intended to represent the prospective financial burden of proposed requirements, and the Permittee Financial Capability Indicators are intended to represent the community's existing financial capacity to accommodate the increased financial burden.

Using this two phase process, Baltimore City currently faces a "medium" burden, as illustrated below. However, this burden will increase substantially in the future as the City continues to implement Consent Decree projects while simultaneously meeting other regulatory requirements and protecting the long-term sustainability of its aging infrastructure. The entire Financial Capability Assessment is presented in Appendix A of this report. As noted in Appendix A, the current analysis does not include projections of the additional O&M costs associated with future infrastructure as those cost projections are not yet available.

The medium burden results of the Affordability Analysis presented in Appendix A is consistent with the results of the City's 2010 Financial Capability Analysis[6].

5 U.S. Environmental Protection Agency, Office of Water. March 1997. *CSO Guidance for Financial Capability Assessment and Schedule Development*, EPA 832-B-97-004.

6 Raftelis Financial Consultants. September 2010. *Affordability Analysis, Sanitary Sewer Overflow Consent Decree, Civil Action No. JFM-02-1524.*

3 EPA'S 2014 FCA FRAMEWORK

The FCA Framework builds on the 1997 Guidance and recognizes advances in financial planning and modeling. EPA has championed a more holistic approach in the FCA Framework, which states that "all CWA costs" will be considered as part of the financial analysis and "Safe Drinking Water Act ("SDWA") obligations will be considered primarily as additional information about a permittee's financial capability."[7]

The FCA Framework further states that permittees should provide EPA with "any additional information that would be useful in understanding those unique or atypical circumstances and how they may affect CWA schedules, so that all relevant information presented by a community can be taken into account to ensure that a full understanding of financial capability guides the development of schedules."[8]

The City believes that a complete understanding of the Consent Decree's financial burden is only possible with the additional information contemplated by the FCA Framework. The EPA's Residential Indicator results in a uniform financial burden based on median income and an average bill for the service area. However, sole reliance on the Residential Indicator does not adequately demonstrate the impact on Baltimore citizens. Income in Baltimore is distributed unevenly and is increasingly concentrated toward the lower end of the spectrum. The uneven distribution of income alone will always result in an unequal distribution of financial burdens that the methodology prescribed in the traditional FCA guidance is incapable of measuring. The traditional FCA also assumes that each customer's financial burden is represented fairly by the average cost per household. In reality, customers place different demands on the system and have different bills as a result, further accentuating differences in financial burdens.

7 U.S. Environmental Protection Agency, K. Kopocis and C. Giles. November 24, 2014. *Memorandum: Financial Capability Assessment Framework for Municipal Clean Water Act Requirements.*

8 Ibid.

4 BALTIMORE CITY'S SERVICE AREA CHARACTERISTICS

The following sections describe Baltimore's recent population trends and socio-economic factors in Section 4.1 and infrastructure financing in Section 4.2.

4.1 Baltimore's Population and Socio-Economic Factors

Annual estimates conducted for the U.S. Census Bureau's American Community Survey place Baltimore's 2014 population at 622,793. The 2000 census reported Baltimore's population at 651,154 indicating a net population loss of 28,361 people (or 4.4%). Concurrent with the loss of population, Baltimore has also seen a loss of total households from 257,788 reported in the 2013 census estimate of 241,455 – a loss of 16,333 households (6.3%) since 2000 when 257,788 households were reported. **Table 4.1** summarizes the 2000 census count and the 2013 census estimate for Baltimore.

Table 4.1. Census Reporting of Population and Households for Baltimore

Year	Population	Households
2000	651,154	257,788
2014 (est.) [1]	622,793	241,455

[1] Based on the U.S. Census Bureau's American Community Survey. Population figures as of July 1, 2014, Household figures for 2009-2013.

The loss of population places an even higher financial burden on the remaining citizens within the City. The higher costs of future regulatory compliance must be paid by an even smaller number of rate payers. All else being equal, declining population means that utility system costs are borne by fewer and fewer rate payers (80 percent or more of utility costs are fixed). Every million dollars in utility costs in 2000 would have been shared by 648,654 people, or $1.54 per capita. The same million dollars in 2013 is shared with just 622,793 people, or $1.61 per capita. However, given that the City's utility costs have increased at 3 times the rate of inflation over that period, the actual impact is much greater; it now costs an inflation-adjusted $2.6 million to provide the same services that cost only $1 million in 2000. Thus, the per capita cost has increased to $4.16, an increase of 158 percent.

In addition to spreading higher costs over a smaller rate payer base, Baltimore must meet the financial challenges associated with its income distribution. Income levels in Baltimore are lower than national or State averages and are more disparate as well. The low-income population base can be seen through a comparison of the percent of households in various annual income ranges in **Figure 4.1**. Baltimore exhibits significantly more disparity at the extremes of income levels than is typical in the U.S. Over 13 percent of the City's population has an annual household income less than $10,000, nearly twice as much as the national average. At the same time, the number of low-income households is not offset by larger numbers of high-income households; high-income households are only about half as many as is typical nationally.

Income disparity such as that seen in Baltimore defies the adjustment for household income inherent in EPA's FCA Framework. Lower median household income results in a lower ceiling on the annual bill before triggering a high burden index, but because Baltimore has so many

residents at very low income levels, the financial burden is not just high, but very high – often two to three times the high burden level as determined by the 1997 Guidance. These ultra-high burdens are not appropriately weighted (by population) in the EPA's methodology and this leads to incorrect conclusions that result in *average* burdens in Baltimore having a much higher impact than would be experienced in communities with less income disparity. These shortcomings, and others, are the topic of discussion in Section 6, Baltimore City's Approach to Accurately Assessing Financial Capability: The Weighted Average Residential Index. That section presents a more detailed evaluation of the financial burdens and proposes a correction to the high burden threshold to account for Baltimore's observed income disparity.

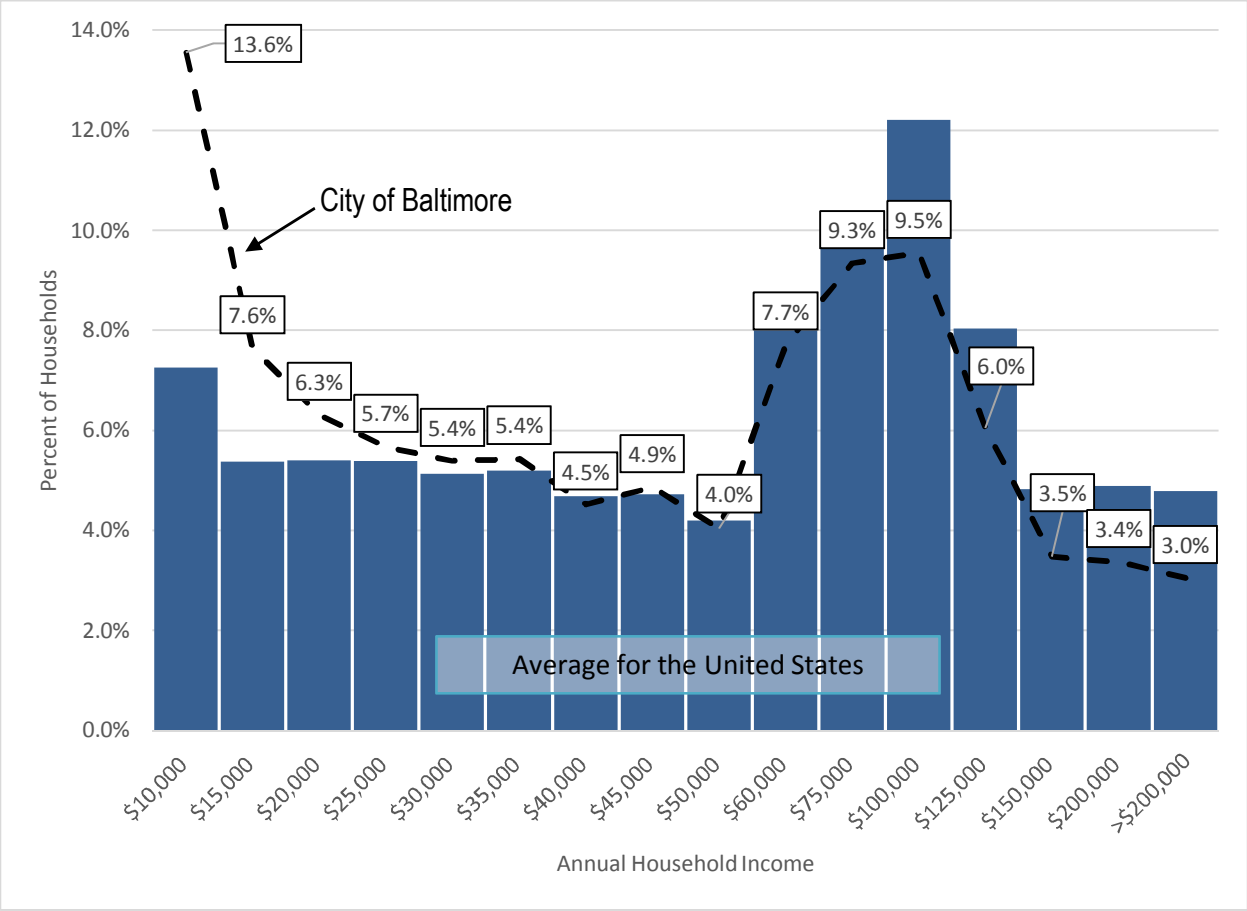

Figure 4.1. Comparison of City of Baltimore and National Household Income (2013)

As illustrated in **Table 4.2**, income growth in Baltimore is nonexistent. Since 2000, median income in the City has remained unchanged after adjusting for inflation. In fact, income levels have decreased over this period.

Table 4.2. Baltimore City Median Household Income (2000-2013)

Year	Reported Median Income	Median Income Adjusted to 2013 Dollars	Annual Growth in Household Income (2013 dollars)
2000	$29,743	$40,237	Not applicable
2009	$38,138	$43,524	0.88% [1]
2010	$39,386	$42,077	-3.32%
2011	$40,100	$41,529	-1.30%
2012	$40,083	$41,401	-0.31%
2013	$41,385	$41,385	-0.04%

[1] Annual values are not available between 2000 and 2009, the 0.88% is a calculated average between the two points.

Poverty in Baltimore is pronounced and can be measured in different ways. **Figure 4.2** incorporates some of the common measurements of poverty used by the federal government and reported by the U.S. Census Bureau. Regardless of the measurement used, the data demonstrates that many City residents have a lower capacity to pay for basic services, such as utility services, than is typical nationally or within the State of Maryland.

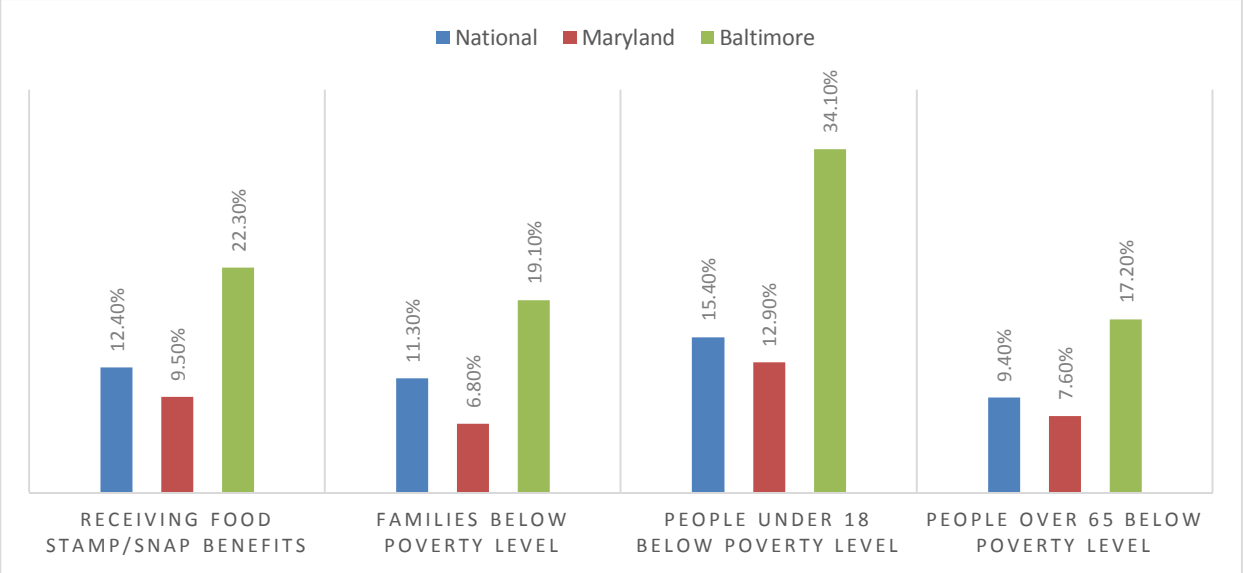

Figure 4.2. Measures of Poverty for Baltimore Compared to State and National Averages

Another way to characterize poverty levels in Baltimore is issuance of disparity grants. The State of Maryland provides an Income Tax Disparity Grant to eligible jurisdictions. The grant is

based on a formula which seeks to increase the per capita income tax yield of the poorest jurisdictions to 75 percent of the statewide average.

Historically, Baltimore City has been one of the largest recipients of this grant, which indicates the City is one of the poorest jurisdictions in the state. The City's relatively larger population partially explains the historic distribution of aid. However, the disparity is better explained by the considerable difference between the City's per capita income tax yield and the statewide average.

For Fiscal Year ("FY") 2016, the City has the third lowest per capita income tax yield in the State. This gap is consistent with previous distributions. **Table 4.3** summarizes the last three years of eligible jurisdictions' per capita income tax yield compared with the statewide average.

Table 4.3. Disparity Grant Per Capita Tax Yield Criteria

Per Capita Income Tax Yield				Capita Tax Yield Difference With Statewide Avg.			
County	**FY 2014**	**FY 2015**	**FY 2016**	**County**	**FY 2014**	**FY 2015**	**FY 2016**
Somerset	$178.92	$184.59	$189.71	Somerset	($397.14)	($437.37)	($424.49)
Allegany	$280.25	$288.71	$295.58	Allegany	($295.81)	($333.25)	($318.62)
Baltimore City	**$303.73**	**$322.44**	**$324.85**	**Baltimore City**	**($272.33)**	**($299.52)**	**($289.35)**
Caroline	$309.18	$326.09	$332.45	Caroline	($266.88)	($295.87)	($381.75)
Dorchester	$297.71	$320.00	$333.04	Dorchester	($278.35)	($301.96)	($281.16)
Wicomico	$320.24	$330.01	$339.00	Wicomico	($255.82)	($291.95)	($275.20)
Garrett	$334.55	$338.64	$354.80	Garrett	($241.51)	($283.32)	($259.40)
Washington	$379.89	$400.17	$409.97	Washington	($196.17)	($221.79)	($204.23)
Prince George's	$401.84	$414.45	$417.42	Prince George's	($174.22)	($207.51)	($196.78)
Cecil	$417.32	$440.40	$445.59	Cecil	($158.74)	($181.56)	($168.61)
Statewide Avg.	$576.06	$621.96	$614.20				

Since 2002, the City has received approximately 67.1 percent of the State's appropriation for this grant, which is paid annually to the City's General fund. This aid represents 4.6 percent of the City's budgeted revenue for FY 2016.

Recent amendments to this program have capped aid to the City at $79.1 million annually. This cap understates the actual amount needed for the City to reach the 75 percent statewide average. For example, the FY 2016 formula indicates that the City would have needed $84.5 million to reach 75 percent of the statewide average per capita income tax yield, not the $79.1 million cap.

4.2 Baltimore's History of Infrastructure Financing

The City operates water, wastewater and stormwater infrastructure serving the City and adjacent counties. Operation of these utilities has encountered significant challenges, including:

- Managing aging, high-risk infrastructure;
- Shifting away from reactive operation and maintenance ("O&M");

- Increasing preventive maintenance capabilities;
- Meeting environmental mandates while sustaining overall utility operations;
- Justifying infrastructure investments;
- Increasing transparency in making infrastructure investment decisions; and
- Providing needed level of service without excessive burden to rate payers.

The following summarizes specific projects the City is pursuing to meet identified infrastructure-related needs for water, wastewater and stormwater.

- Water Transmission and Distribution System. The City of Baltimore's water distribution system comprises nearly 3,800 miles of water distribution mains that serve 1.8 million customers. An additional 700 miles of water main, which is also maintained by the City, serves customers in parts of Anne Arundel, Baltimore and Howard Counties. The average age of City water mains is 75 years old, and a majority of the system has reached the end of its service life as evidenced by the increasing number of breaks (1,136 water main breaks recorded in calendar year 2013). Although age itself does not render a pipe useless, the pipe can weaken over time so when the surrounding soil shifts and support is lost, the pipe is subject to breaks. Breaks are especially common during the freeze-thaw periods of winter when hundreds of breaks must be addressed (353 in January 2014).
- Water System Preventive Maintenance. With the creation of the new Office of Asset Management ("OAM"), the City has implemented the following water system preventive maintenance projects (in addition to wastewater and stormwater preventive maintenance noted elsewhere): leak detection; valve and hydrant exercising and assessment; and transmission main condition assessment and monitoring. Planned for implementation are a main flushing program; a comprehensive large-diameter pipeline condition assessment program for precast concrete cylinder pipe ("PCCP") mains that are of particular risk of breakage; and a customer compliant "root cause" analysis program.
- Long Term Enhanced Surface Water Treatment Rule ("LT2 Rule"). The City has five uncovered finished water reservoirs that are subject to the LT2 Rule that mandates either reservoir covers or post-treatment for water being discharged from the uncovered reservoirs.
- Water Treatment. Under the City's long-term master plan, a new Fullerton Water Filtration Plant ("WFP") will be constructed and the Montebello WFP may be expanded to allow the use of the Susquehanna as a regular raw water source to meet projected water treatment needs. A new Fullerton WFP will also allow to take out service the aging Montebello WFPs, placed into service in 1915 and 1926, off-line for a comprehensive refurbishment. These projects are required to ensure a sustainable supply of potable water to City and adjacent county residents.
- Wastewater Treatment. The City is completing Enhanced Nutrient Removal ("ENR") facilities at both the Back River Wastewater Treatment Plant ("WWTP") and the Patapsco WWTP in addition to resolving a recently discovered hydraulic restriction at the Back River WWTP headworks.
- Wastewater Collection. Under the 2002 Consent Decree, the City has completed comprehensive sewer system evaluation surveys ("SSES") for each of the eight

sewersheds within the collection system. Projects are currently underway to complete structural repairs for defined defects; 60 of the 62-originally identified constructed SSO structures have been eliminated (as documented in the City's reports to EPA/MDE additional constructed SSO locations have been identified through subsequent sewer system evaluations and a schedule for closure has been proposed); the Jones Falls Pumping Station has been upgraded; and the combined sewers in Forest Park and Walbrook were separated.

Under the proposed adaptive management approach to the remaining Consent Decree activities, Phase 1 projects will complete the structural repairs, close the remaining constructed SSO structures, complete heavy cleaning of several of the City's major interceptor sewers; complete 23 priority sewer meter basin infiltration and inflow (I/I) removal projects; complete selected conveyance upgrades to initiate Hybrid Level of Protection ("LOP") improvements within the Patapsco and High Level Sewersheds and along the Chinquapin Interceptor; add storage capacity at the Back River WWTP; and complete the hydraulic restriction removal at the Back River WWTP to allow the elimination of the remaining two constructed SSOs. Based on the results of the flow monitoring to assess I/I removal effectiveness, additional conveyance system upgrades; additional meter basin rehabilitation as needed; and additional flow storage or high-rate wet weather treatment facilities as required will have projects defined and implemented. The OAM is also implementing several preventive O&M programs focused on the collection system assets, including such programs and fats, oils and grease ("FOG") control, chemical applications for root control, and lateral inspection and repair to move the City from reactive maintenance to a more proactive O&M and facilitate meeting Consent Decree requirements to eliminate SSOs.

- Stormwater Municipal Separate Storm Sewer System ("MS4"). The City's 2013 MS4 Permit requires restoration of 20 percent of the impervious area within the City, which is equivalent to over 4,000 acres to achieve 2017 Interim goals of the Chesapeake Bay Total Maximum Daily Load ("TMDL") program. The costs of current MS4 Permit compliance is expected to exceed $50 million through Fiscal Year ("FY") 2018. With the installation of both existing and proposed Best Management Practices ("BMP") designed to control stormwater runoff and reduce pollution of receiving waters, significant additional expenditures will be required to maintain the BMP installations and ensure the BMPs continue to function as designed.

Meeting these needs requires substantial increases in annual investments. These investments, while necessary, come at great expense and high financial burdens to many Baltimore residents.

In particular, the 2002 Consent Decree has been the source of many of these investments and related costs over the past 13 years. The City has expended over $710 million in Consent Decree-related projects alone. The Consent Decree effectively mandated a significant level of investment in the City's wastewater system during that time. Simultaneously, however, the City has also faced urgent needs in its drinking water and stormwater systems as briefly summarized above. **Figure 4.3** shows the annual CIP appropriations for water and wastewater, including all funding sources. As shown, the wastewater appropriations dominate through FY 2011 before decreasing slightly in FY 2012 and FY 2013, and then dominating again in FY 2014 and FY 2015.

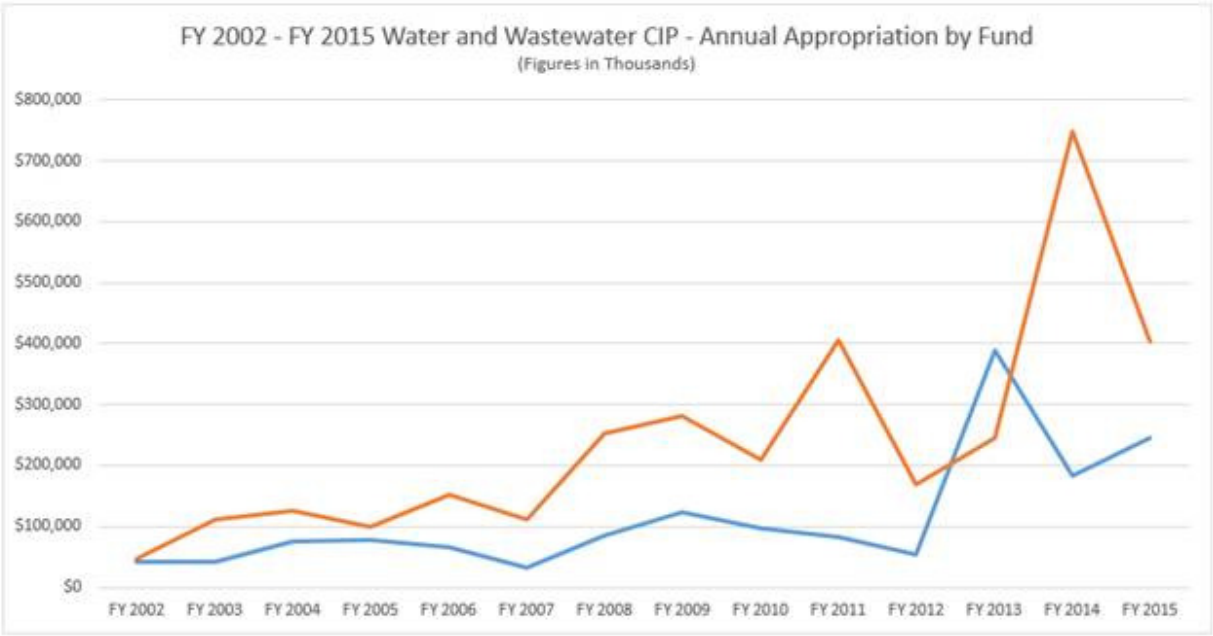

Figure 4.3. Water and Wastewater Annual CIP Appropriations (FY 2002 – FY 2015)

(Total appropriation from all funding sources)

Similarly, utility rates in the City have increased substantially since 1998 as the City began to anticipate and address these needs. With the most recent rate increase, which was adopted in July 2013, Baltimore raised water and sewer rates by 42 percent over the last 3 years. As a result, rates were increased by 15 percent in FY 2014, followed by increases of 11 percent in both FY 2015 and FY 2016. From 1998 to the start of the original Consent Decree in 2002, rates increased 1.33 times more than inflation in the water system and 1.22 times more for the wastewater system. Between 2002 and 2015, water and sewer rates have increased 2.45 times faster than inflation.

In sum, a typical Baltimore household's combined water and sewer bill has increased 4-fold since 1998. For example, if a Baltimore resident were paying a combined annual water and sewer bill of $151 in 1998, that same service now costs $640 (estimated average annual bill for 2015). Meanwhile, the inflation-adjusted value of the same $151 is worth just $217 in 2015 dollars. Simply put, utility rates in Baltimore have increased at three times the rate of inflation since 1998. The average water, sewer and stormwater combined annual bill in Baltimore today is $640.

Figure 4.4 illustrates the annual bills between 1998 and 2015.

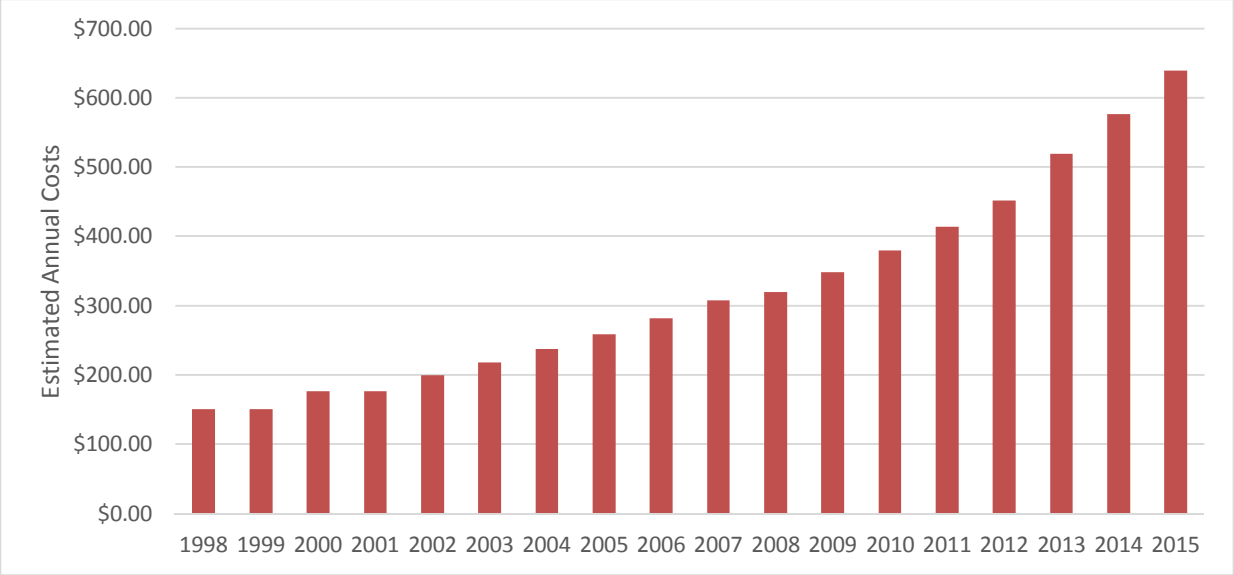

Figure 4.4. The Cost to Ratepayers of Combined Water, Sewer and Stormwater Service in Baltimore from 1998-2015

5 BALTIMORE CITY'S INTEGRATED PLAN

Since 1998, Baltimore City has made the politically difficult choice to steadily increase the financial burden it has placed on its economically stressed ratepayers in order to comply with regulatory requirements and maintain its water, wastewater and stormwater systems.

Baltimore City faces a considerable challenge in constructing and maintaining its critical infrastructure. In future years, the City must meet the requirements of its Consent Decree; complete enhanced nutrient removal upgrades to two wastewater treatment plants; maintain compliance of the water system with the SDWA; initiate stormwater improvements to comply with the City's MS4 permit; and do all of this while continuing to address the decline of the City's aging infrastructure in general.

Each of these challenges is made all the more difficult by the fact that Baltimore's residents have endured the quadrupling of their bills since 1998, with the scale of the rate increases escalating over the last decade, while household incomes have failed to increase at all. Addressing the affordability of future programs to meet regulatory mandates is a priority for the City's leadership. All future investments, including those necessary for regulatory compliance, must be implemented in the most affordable and efficient manner possible as Baltimore's low-income households are already struggling to pay their water, sewer and stormwater bills and moderate-income households are now experiencing the growing difficulty to pay as well.

The Integrated Planning Framework ("IPF")[9] is a process that allows communities such as Baltimore to develop and propose capital project schedules based on achieving the greatest total benefits, including regulatory compliance. The City engaged in an IPF process to evaluate obligations under both the CWA and the SDWA. The Baltimore Integrated Plan encompasses the City's infrastructure needs for its drinking water, wastewater and stormwater systems as a whole, inclusive of improvements necessary for compliance with CWA and SDWA.

The capital expenditures identified in the Integrated Plan comprise the City's comprehensive infrastructure needs for the 2016 to 2034 planning period, which is the time frame predicted by the Baltimore Integrated Plan analysis that will be required to complete Consent Decree-mandated projects. The total cost of the Integrated Plan exceeds $4.1 billion, including $2.2 billion in the Water Fund, $1.4 billion in the Wastewater Fund and $0.4 billion in the Stormwater Fund. The total values for each year are presented in **Table 5.1**.

[9] U.S. Environmental Protection Agency. June 5, 2012. *Integrated Municipal Stormwater and Wastewater Planning Approach Framework.*

Table 5.1. Integrated Plan Costs (in 2016 Dollars)

Year	Water Fund	Sewer Fund	Stormwater Fund	Total Annual Capital Spending
2016	$145,500,000	$94,600,000	$10,000,000	$250,100,000
2017	140,600,000	96,100,000	14,000,000	250,700,000
2018	133,900,000	91,600,000	25,900,000	251,400,000
2019	126,000,000	106,300,000	19,900,000	252,200,000
2020	142,000,000	92,600,000	18,100,000	252,700,000
2021	156,400,000	70,900,000	23,800,000	251,100,000
2022	150,400,000	77,900,000	19,300,000	247,600,000
2023	162,400,000	64,900,000	17,000,000	244,300,000
2024	145,800,000	81,900,000	20,100,000	247,800,000
2025	115,300,000	117,100,000	15,500,000	247,900,000
2026	95,600,000	106,000,000	26,200,000	227,800,000
2027	75,000,000	84,900,000	54,000,000	213,900,000
2028	114,200,000	95,200,000	28,200,000	237,600,000
2029	172,200,000	61,900,000	17,500,000	251,600,000
2030	166,100,000	48,500,000	18,100,000	232,700,000
2031	102,100,000	48,200,000	18,000,000	168,300,000
2032	31,500,000	33,700,000	20,000,000	85,200,000
2033	35,600,000	15,100,000	23,500,000	74,200,000
2034	38,700,000	22,800,000	21,400,000	82,900,000
Totals	**$2,249,300,000**	**$1,410,200,000**	**$410,500,000**	**$4,070,000,000**

Under the Integrated Plan, capital spending is distributed more sustainably than the current schedule for the Consent Decree. Specifically, wastewater spending no longer dominates the budget by crowding out investment in the drinking water system (as previously demonstrated in Figure 4.3). Instead, the Integrated Plan directs funding to the water system to protect public health and safety by addressing critical decaying infrastructure and protecting the water supply and provides a more balanced approach to the City's overall infrastructure needs. Stormwater spending gradually increases to address stormwater quality and quantity concerns under the City's MS4 permit. In short, the Integrated Plan achieves a wide array of environmental and other benefits by ensuring balanced investment to maximize benefits to the environment and public health as early as possible and at the lowest cost while ensuring regulatory compliance.

The City's affordability analysis is based on the spending recommended by its Integrated Plan.

6 BALTIMORE CITY'S APPROACH TO ACCURATELY ASSESSING FINANCIAL CAPABILITY: THE WEIGHTED AVERAGE RESIDENTIAL INDEX

The FCA Framework allows the City to take the City's true demographic and historical information into account. The City's consultant MWH Americas, Inc. ("MWH") developed the Weighted Average Residential Index (WARi) to more accurately demonstrate the impact of water and sewer rate increases on City residents at a number of income levels. WARi evaluates income levels and financial burdens for each census tract and projects that data into GIS layers in order to evaluate the impact of rising water and wastewater rates throughout the City.

The U.S. Census Bureau's American Community Survey reports the number of households at various income levels within sixteen standardized income levels for each census tract. As such, there are sixteen data points available for each census tract to inform the skew in the population of household incomes. Each census tract also has a unique median household income. WARi uses all 16 data points to assess income distribution for every census tract in the City. WARi also uses the City's billing database to analyze actual water bills for each census tract to compare what customers are being charged with their household income.

Table 6.1, on the following page, illustrates the detail available from a WARi analysis for a single census tract. WARi repeats this analysis for each of 198 census tracts in the City to determine a population-weighted average of all financial burdens. In each census tract, financial burden is calculated as the actual average bill for the tract ($651.43 per year, in the example below) by the mid-point of income of each income level. From there, a weighted burden is calculated by multiplying the percentage of households in the income level by the financial burden for that income level (see last column below). In the example below, the financial burden for the tract is 6.5 percent of the median household income within each income level. This weighted burden is called the weighted average residential index for the tract. These steps are repeated for every census tract, and again for every year in the financial planning forecast, which in Baltimore's case extends to 2034.

Table 6.1. Example of WARi Census Tract Data

For Census Tract 301
Avg. Utility Bill in Tract $651.43

Income Level	Income Mid-Point	Households	% Households	Burden	Weighted Burden
< $10,000	$5,000	414	39.3%	13.0%	5.1%
$10,001 - $15,000	$12,500	101	9.6%	5.2%	0.5%
$15,001 - $20,000	$17,500	67	6.4%	3.7%	0.2%
$20,001 - $25,000	$22,500	25	2.4%	2.9%	0.1%
$25,001 - $30,000	$27,500	53	5.0%	2.4%	0.1%
$30,001 - $35,000	$32,500	83	7.9%	2.0%	0.2%
$35,001 - $40,000	$37,500	47	4.5%	1.7%	0.1%
$40,001 - $45,000	$42,500	40	3.8%	1.5%	0.1%
$45,001 - $50,000	$47,500	42	4.0%	1.4%	0.1%
$50,001 - $60,000	$55,000	24	2.3%	1.2%	0.0%
$60,001 - $75,000	$67,500	65	6.2%	1.0%	0.1%
$75,001 - $100,000	$87,500	58	5.5%	0.7%	0.0%
$100,001 - $125,000	$112,500	8	0.8%	0.6%	0.0%
$125,001 - $150,000	$137,500	7	0.7%	0.5%	0.0%
$150,000 - $200,000	$175,000	20	1.9%	0.4%	0.0%
> $200,000	$200,000	0	0%	0.3%	0.0%
			Weighted Avg. Res. Index		6.5%

By examining the details of the demographic data in such a way, a very different picture of financial burdens begins to emerge. While the median financial burdens may indeed be moderate, there are a vast number of residents whose burdens are not just high, but very high with burdens 2 to 3 times higher than the guideline 4.5 percent threshold[10] suggests as "high." A graphical depiction of those burdens as estimated for the Integrated Plan is shown below in **Figure 6.1**. The fiscal year residential index is presented in different colors to represent the change over time. The spikes in the graph represent census tracts that have higher numbers of low income households. The spikes with a greater change over time represent census tracts with greater income inequality. The figures show the wide dispersion of financial burdens in Baltimore compared to the 4.5 percent threshold, and demonstrate the expected increase in those burdens over time through 2034.[11]

[10] Please refer to Appendix A for a discussion on how and why the 4.5% threshold is proposed for this analysis.

[11] U.S. Environmental Protection Agency. February 1998. *Information for States on Developing Affordability Criteria for Drinking Water.*

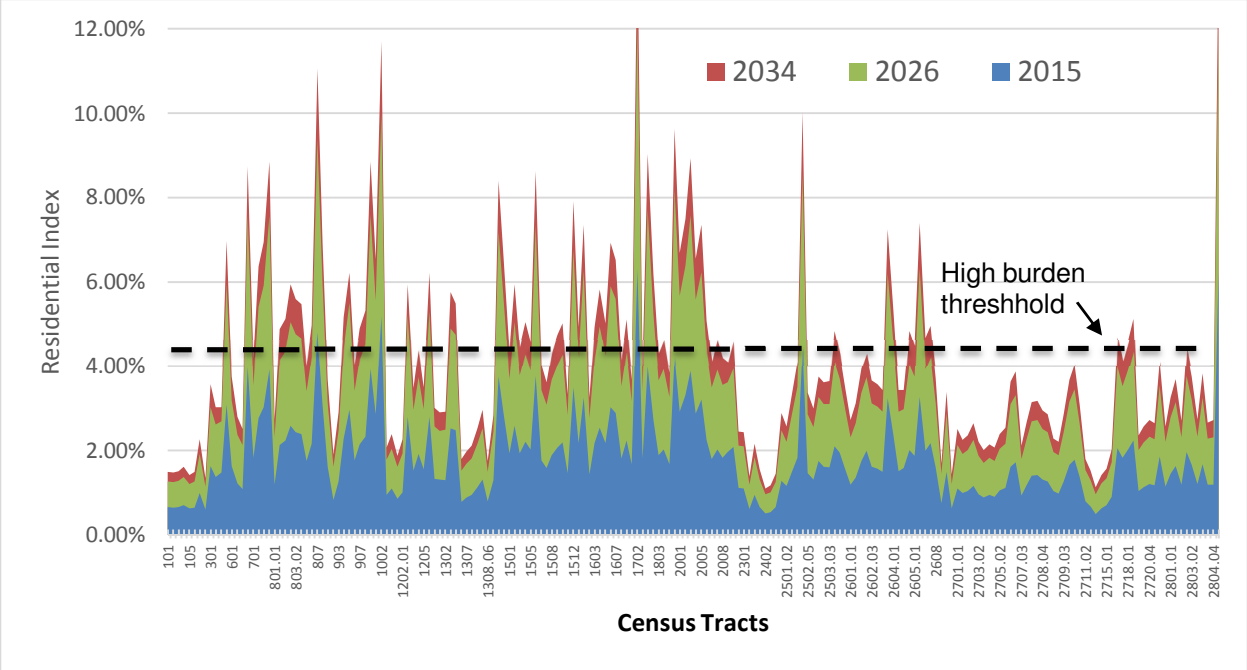

Figure 6.1. Projection of Financial Burdens by Census Tract

These burdens can be plotted on a map to illustrate how the financial burden increases over the proposed term of the Consent Decree (see **Table 6.2** and **Figures 6.2, 6.3** and **6.4**). In these maps, a census tract shows as red when at least 50 percent of the households in it exceed the high burden threshold. In the census tracts showing as green, there are still many households which exceed the high burden threshold, but it is not the majority of households in that census tract.

Table 6.2. Affordability Index Table and Map Key

Financial Impact		Index	Color
Low	Less than	2.25%	
Low-Mid	Up to	3.38%	
Mid	Up to	3.94%	
Mid-High	Up to	4.49%	
High	Higher than	4.50%	

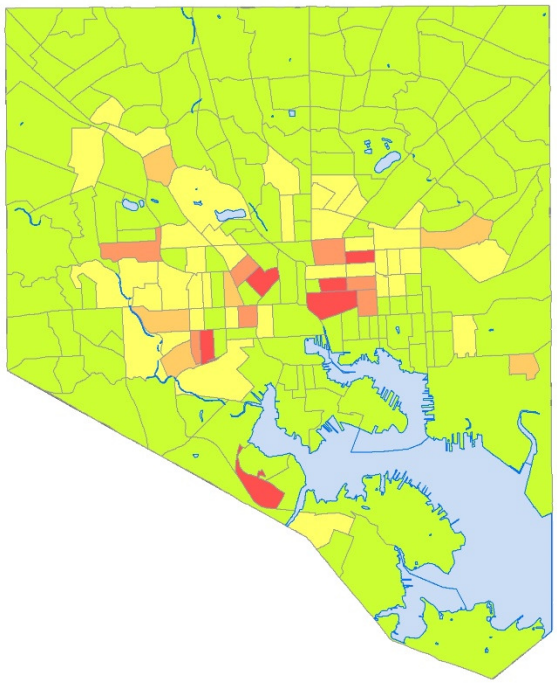

Figure 6.2. 2016 Affordability Map

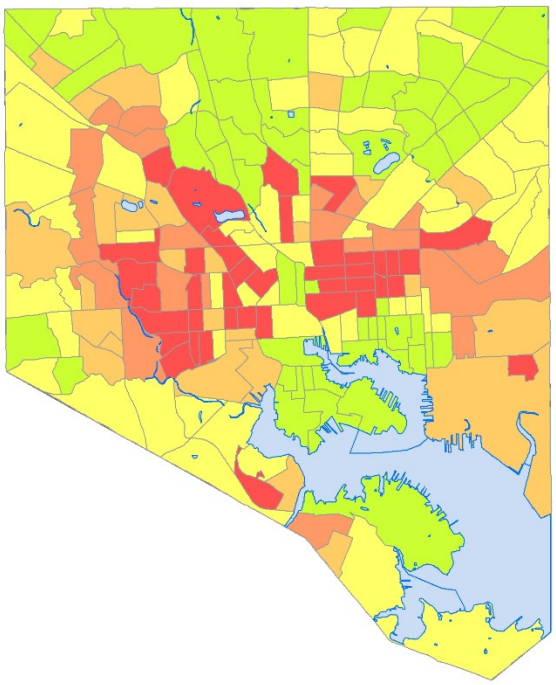

Figure 6.3. 2026 Affordability Map

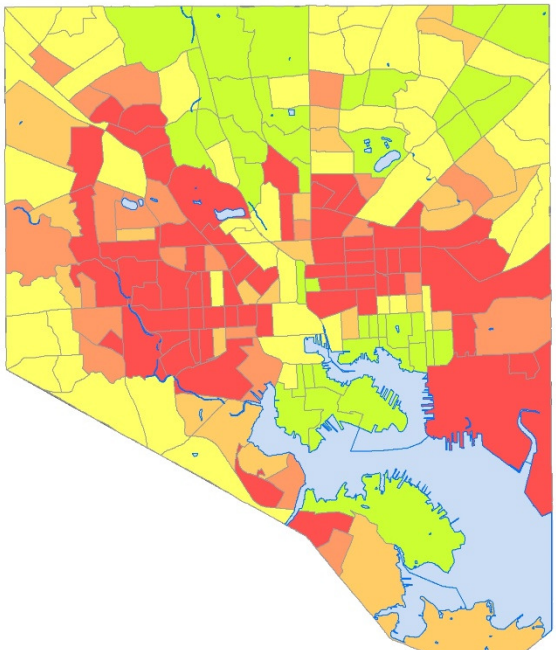

Figure 6.4. 2034 Affordability Map

7 ADJUSTING THE HIGH BURDEN THRESHOLD FOR BALTIMORE'S INCOME DISPARITY

Examination of the WARi results demonstrates the fact that financial burdens vary widely across Baltimore's population with a preponderance of high burdens that are *much* higher than 4.5 percent. Therefore, a 4.5 percent threshold based only on median income is not indicative of financial burdens in Baltimore. This is shown by comparing weighted average burdens between the United States average, and those of Baltimore. WARi is calculated for both the U.S. and Baltimore in **Table 7.1**, below, based on a maximum bill equal to 4.5 percent of the median incomes for both ($53,046 U.S., $41,385 for Baltimore based on the most recent Census data). If the 4.5 percent threshold were equally valid in both cases, then the WARi for both populations would be equal. However, as demonstrated below, the value for Baltimore is 8.5 percent higher than it is for the United States. This indicates that the threshold of "high burden" itself is skewed with respect to Baltimore by approximately 8.5 percent. The term "skew" is used to describe how Baltimore's income distribution is tilted toward the low income levels more than is typical for the wider population at large.

Table 7.1. Weighted Average Residential Index Values at a 4.5% Median Bill for the United States and Baltimore City

		United States			Baltimore City		
Income Bins	Bin Midpoint	% Population in Bin	Bill as % of Midpoint	Weighted Impact	% Population in Bin	Bill as % of Midpoint	Weighted Impact
< $10,000	5,000	7.2%	47.7%	3.4%	13.6%	37.2%	5.0%
$10,001 - $15,000	12,500	5.4%	19.1%	1.0%	7.6%	14.9%	1.1%
$15,001 - $20,000	17,500	5.4%	13.6%	0.7%	6.3%	10.6%	0.7%
$20,001 - $25,000	22,500	5.4%	10.6%	0.6%	5.7%	8.3%	0.5%
$25,001 - $30,000	27,500	5.1%	8.7%	0.4%	5.4%	6.8%	0.4%
$30,001 - $35,000	32,500	5.2%	7.3%	0.4%	5.4%	5.7%	0.3%
$35,001 - $40,000	37,500	4.7%	6.4%	0.3%	4.5%	5.0%	0.2%
$40,001 - $45,000	42,500	4.7%	5.6%	0.3%	4.9%	4.4%	0.2%
$45,001 - $50,000	47,500	4.2%	5.0%	0.2%	4.0%	3.9%	0.2%
$50,001 - $60,000	55,000	8.0%	4.3%	0.3%	7.7%	3.4%	0.3%
$60,001 - $75,000	67,500	9.9%	3.5%	0.4%	9.3%	2.8%	0.3%
$75,001 - $100,000	87,500	12.2%	2.7%	0.3%	9.5%	2.1%	0.2%
$100,001 - $125,000	112,500	8.0%	2.1%	0.2%	6.0%	1.7%	0.1%
$125,001 - $150,000	137,500	4.8%	1.7%	0.1%	3.5%	1.4%	0.0%
$150,000 - $200,000	175,000	4.9%	1.4%	0.1%	3.4%	1.1%	0.0%
> $200,000	200,000	4.8%	1.2%	0.1%	3.0%	0.9%	0.0%
Total Weighted Average Residential Indicator				8.8%			9.5%
Skew %							8.5%

Instead of a 4.5 percent threshold for "high burdens" the threshold itself should be adjusted to reflect the degree of income skew relative to Baltimore's particular demographics. A simple adjustment to the 4.5 percent threshold using the 8.5 percent skew determined in Table 7.1 results in an adjusted threshold level of 4.13 percent. Making this adjustment brings the WARi values in the table into equilibrium.

The result of the above adjustment is a step change in how Baltimore would evaluate its financial burdens going forward. When adjusted for skew, a "high burden" would occur at 4.13 percent of household income rather than 4.5 percent and other thresholds (e.g., for "medium burden") would be similarly adjusted as well. The difference is meaningful to Baltimore because it indicates that the remaining financial capacity in the City is much lower than it might have been viewed without the needed adjustment for skew. **Figure 7.1**, below, shows a comparison of the financial capacity in Baltimore. The bar to the left shows the capacity remaining between the current residential index and a high burden threshold of 4.5 percent; the second bar shows the remaining capacity with a skew-adjusted 4.13 percent threshold. Where there would be 15 percent remaining capacity in the former case, the adjusted threshold results in a reduction in capacity to below 5 percent.

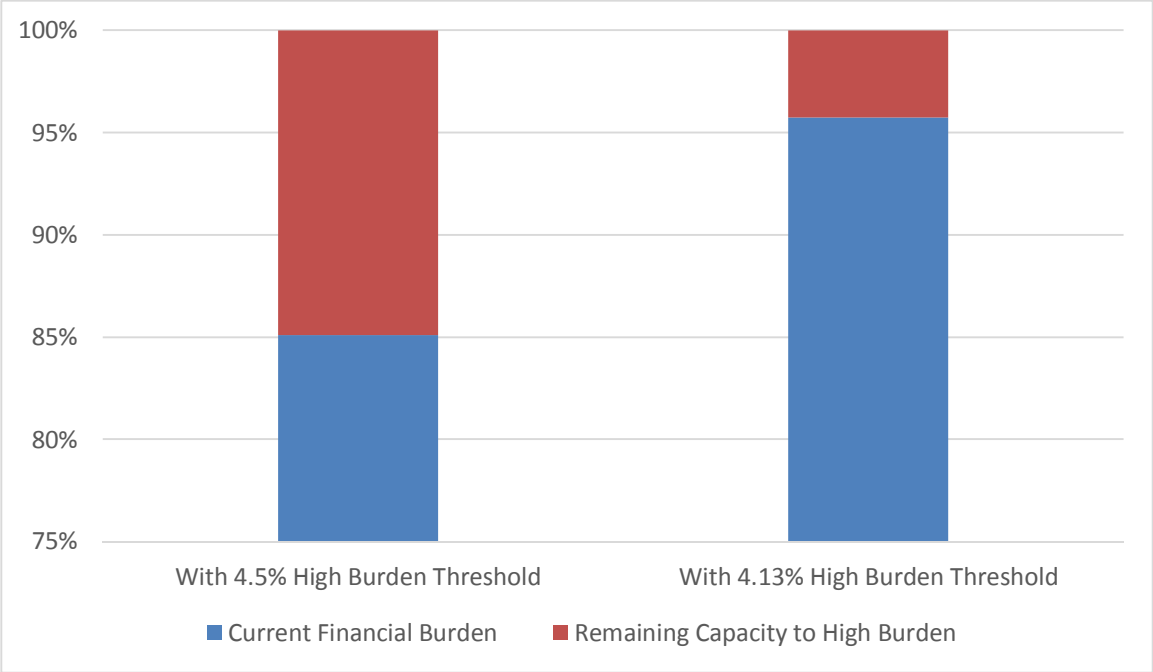

Figure 7.1. Comparison of Adjusted and Unadjusted Financial Capacity in Baltimore

The difference illustrated above is more noticeable when applied to cost figures. With a threshold of 4.5 percent, the City could theoretically "afford" a maximum annual bill of $1,862, which is $416 more than the current level. With 241,455 households, that additional $416 would generate $100.5 million in additional revenue. The amount falls to just $63.2 million under the adjusted threshold of 4.13 percent, as the maximum bill drops to $1,709 per year, only $263 more than present.

The seemingly small adjustment to the high burden threshold results in a 37 percent difference in the City's relative burden, and it lowers the ceiling for what may be considered a "medium burden." More importantly, the loss of $37 million in annual financial capacity is the equivalent of permanently losing approximately $600 million in needed infrastructure investment.

The above findings imply that the City has very little room for error before triggering a high burden. An increase of a mere 1 percent in annual rate increases for each of the three utility rates, for example, would cause the Residential Indicator in 2034 to exceed 4.5 percent, resulting in a "high burden" under current EPA 2014 Financial Guidance and far exceeding that level based on the more appropriate threshold of 4.13 percent.

In sum, the City's ability to fund additional operational or capital costs in the future is severely constrained. Affordability will remain a major, growing concern for the City and its citizens.

7.1 Projected Financial Burdens

Table 7.2, on the following page, is a summary of the WARi analysis. The table combines the outcomes of the more detailed WARi analysis and presents the findings for the City as a whole. The WARi analysis is a long-range projection, but all values are presented in 2015 dollars. In addition, the number of households is held constant at 241,455 therefore assuming no growth, but also not projecting the recent downward trend in population into the future.

Table 7.2. Summary of WARi Analysis and Other Significant Outputs for Selected Years

				2016		2026		2034	
Income Level	Income Mid-Point	Households [1]	% Households	Burden [2]	Weighted Burden	Burden [2]	Weighted Burden	Burden [2]	Weighted Burden
< $10,000	$5,000	32,720	13.6%	13.4%	1.8%	23.5%	3.2%	27.5%	3.7%
$10,001 - $15,000	$12,500	18,465	7.6%	5.4%	0.4%	9.4%	0.7%	11.0%	0.8%
$15,001 - $20,000	$17,500	15,238	6.3%	3.8%	0.2%	6.7%	0.4%	7.9%	0.5%
$20,001 - $25,000	$22,500	13,705	5.7%	3.0%	0.2%	5.2%	0.3%	6.1%	0.3%
$25,001 - $30,000	$27,500	13,019	5.4%	2.4%	0.1%	4.3%	0.2%	5.0%	0.3%
$30,001 - $35,000	$32,500	13,127	5.4%	2.1%	0.1%	3.6%	0.2%	4.2%	0.2%
$35,001 - $40,000	$37,500	10,924	4.5%	1.8%	0.1%	3.1%	0.1%	3.7%	0.2%
$40,001 - $45,000	$42,500	11,762	4.9%	1.6%	0.1%	2.8%	0.1%	3.2%	0.2%
$45,001 - $50,000	$47,500	9,756	4.0%	1.4%	0.1%	2.5%	0.1%	2.9%	0.1%
$50,001 - $60,000	$55,000	18,644	7.7%	1.2%	0.1%	2.1%	0.2%	2.5%	0.2%
$60,001 - $75,000	$67,500	22,557	9.3%	1.0%	0.1%	1.7%	0.2%	2.0%	0.2%
$75,001 - $100,000	$87,500	23,056	9.5%	0.8%	0.1%	1.3%	0.1%	1.6%	0.2%
$100,001 - $125,000	$112,500	14,595	6.0%	0.6%	0.0%	1.0%	0.1%	1.2%	0.1%
$125,001 - $150,000	$137,500	8,375	3.5%	0.5%	0.0%	0.9%	0.0%	1.0%	0.0%
$150,000 - $200,000	$175,000	8,150	3.4%	0.4%	0.0%	0.7%	0.0%	0.8%	0.0%
> $200,000	$200,000	7,362	3.0%	0.3%	0.0%	0.6%	0.0%	0.7%	0.0%
Totals		**241,455**			**3.44%**		**6.01%**		**7.04%**
Equivalent Residential Index [3]					1.81%		3.27%		3.83%
High Burden Threshold [4]					4.13%		4.13%		4.13%
Remaining Financial Capacity Before High Burden					2.32%		0.86%		0.30%

Table 7.2 continued on next page (including footnotes)

Table 7.2 Continued

Max Bill @ High Burden Threshold (2015 dollars) [5]	$1,708.00	$1,708.00	$1,708.00
Estimated Avg. Bill for Year (2015 dollars) [6]	$694.75	$1,218.47	$1,423.50
$ of Remaining Capacity	$1,013.25	$489.53	$284.50
Total $ of Remaining Capacity (2015 dollars, $ million) [7]	$244.65	$118.19	$68.69

Footnotes:

1 From 2013 U.S. Census Bureau's American Community Survey. Household numbers are held constant for future periods.

2 Calculated based on a projection of actual bills for each census tract relative to the mid-point for the income level indicated. There are 128 total census tracts included in the calculation of average burden for each income level shown.

3 The average bill for each census tract is divided by its median household income to determine the residential index for each tract; the value shown is the average residential impact for all 128 census tracts.

4 High burden threshold of 4.5% adjusted for skew of 8.5% as presented in Table 7.1.

5 The maximum average annual bill possible before causing a high burden for the service area as a whole. Equal to 4.13% of the most recent MHI reported by the U.S. Census Bureau's 2013 American Community Survey.

6 Based on a projection of actual bills for each census tract.

7 Remaining capacity per bill (previous line) times the number of households (241,455). Dollars are in millions.

Table 7.3 presents the affordability thresholds, revised based on the adjustment for skew. **Figures 7.2** through **7.4** present a comparison of the unadjusted and adjusted Affordability Maps.

Table 7.3. Skew Adjusted Affordability Index Table and Map Key

Financial Impact		Unadjusted Index	Adjusted Index	Color
Low	Less than	2.25%	2.07%	
Low-Mid	Up to	3.38%	3.10%	
Mid	Up to	3.94%	3.61%	
Mid-High	Up to	4.49%	4.12%	
High	Higher than	4.50%	4.13%	

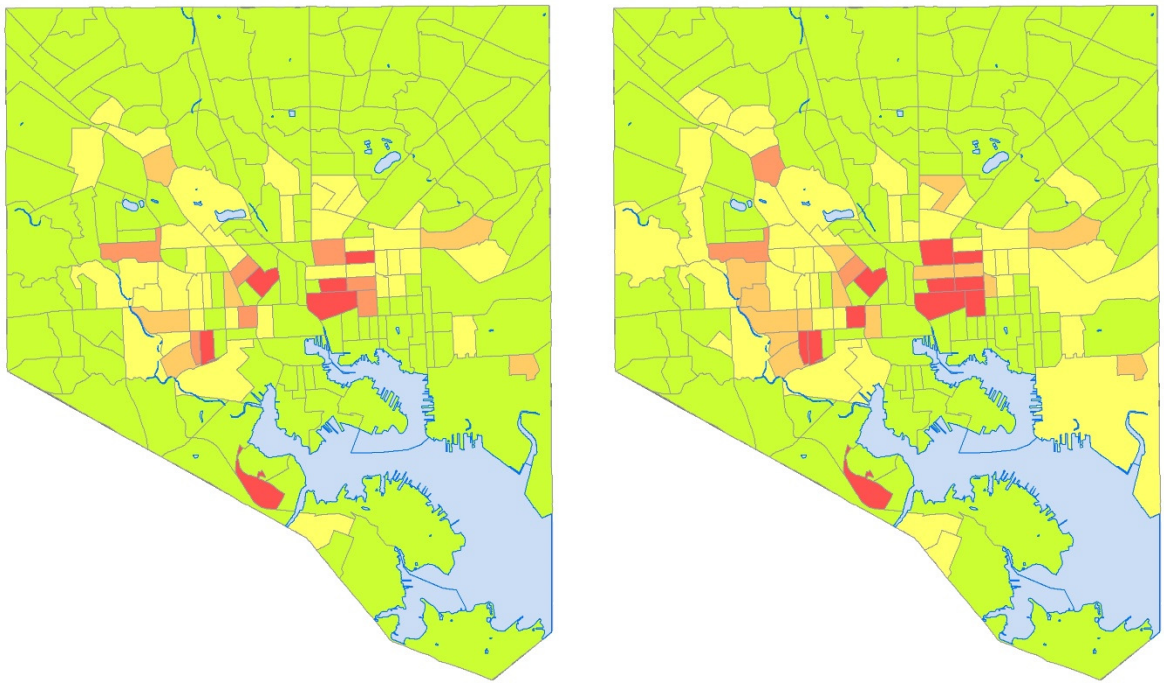

Figure 7.2. 2016 Affordability Map, Unadjusted and Adjusted

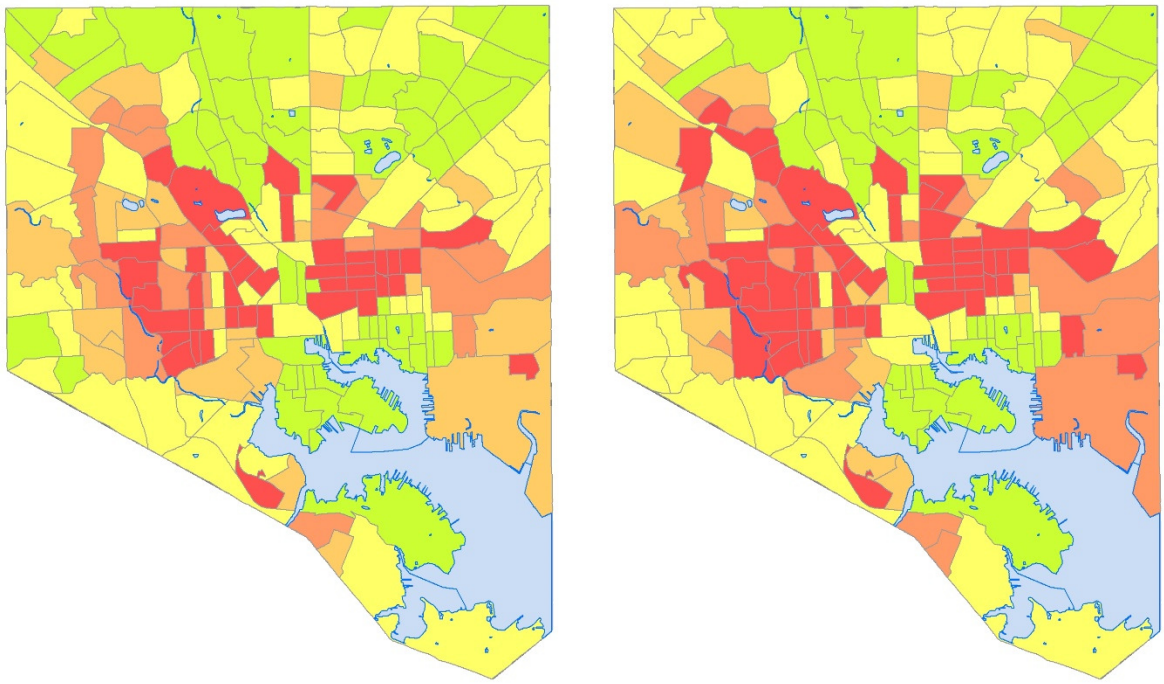

Figure 7.3. 2026 Affordability Map, Unadjusted and Adjusted

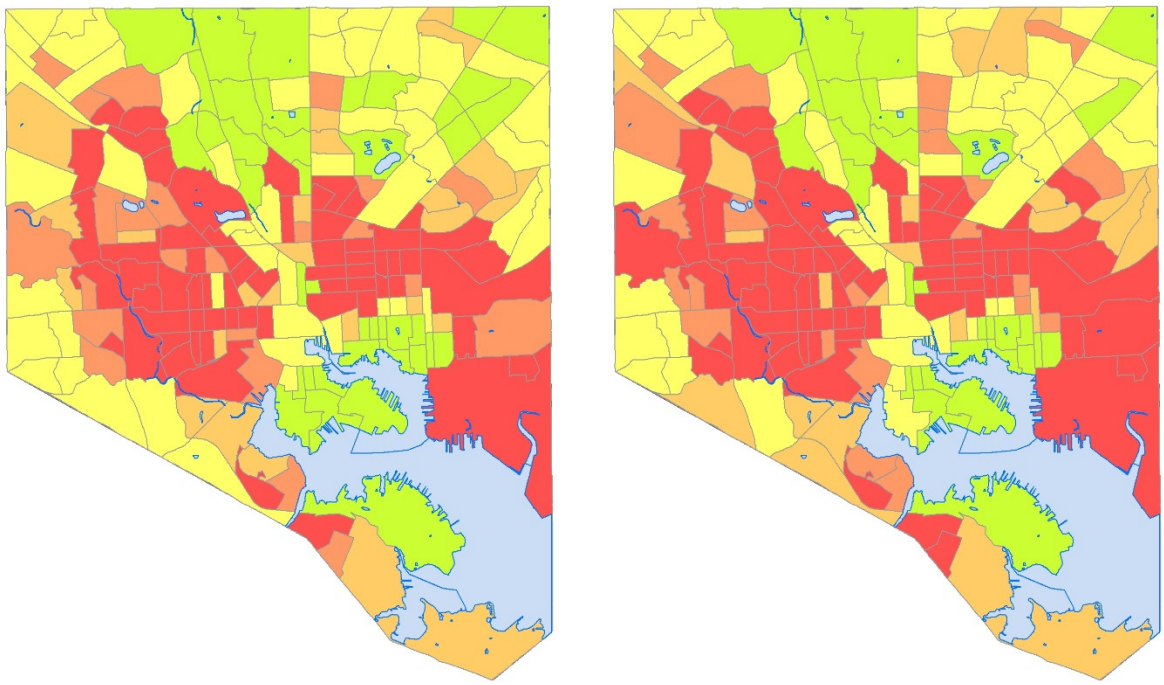

Figure 7.4. 2034 Affordability Map, Unadjusted and Adjusted

Due to the detailed data analysis provided in the WARi analysis, the City is also able to easily count the number of households for whom the average utility bill will represent a high burden. Counting the number of households that exceed the 4.13 percent adjusted high-burden threshold results in a simple metric of high-burden households to less-than-high burden households. **Figure 7.5** depicts the count of high-burden households between 2016 and 2034, covering the range of the Integrated Plan implementation period. During this period, the number of households for whom utility bills will become high burdens will nearly double from 22 percent of households in 2016 to 40 percent in 2034. Over 98,000 households will have a high financial burden in Baltimore by 2034.

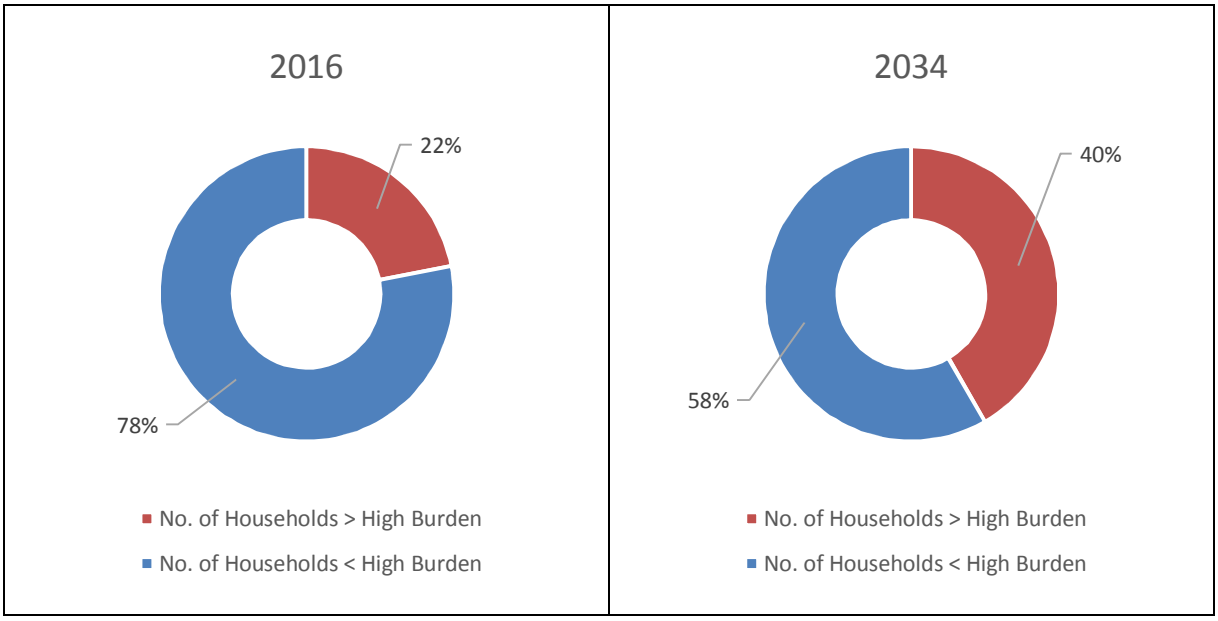

Figure 7.5. Percentage of Households with High Financial Burdens 2016 and 2034

8 CONCLUSIONS

The City has worked diligently to respect the terms of the 2002 Consent Decree and to make every possible progress in reducing the number and volume of SSOs. The City has used new techniques to better model for and analyze the impact of real rainfall events on its sanitary sewer system. It has embraced the EPA concept of the Integrated Planning Framework and will be one of the first cities to produce a detailed and thoughtful plan for a strategic and balanced capital investment program that prioritizes projects having the greatest environmental, social and public health benefits while recognizing economic efficiencies.

As challenging as it is to engineer and construct improvements to an aging sanitary sewer system serving an entire city, paying for these improvements within a prescribed period is proving to be one of the biggest challenges of the Consent Decree. While regulatory expectations and costs have grown, the capacity for the City's low- and moderate-income households to pay for current and prospective projects is diminishing. Even employing the Integrated Planning Framework as a basis for extending the Consent Decree end date to 2034 will not protect 40 percent of the City's population from receiving water, sewer and stormwater bills they will ultimately not be able to afford to pay.

The EPA produced a 1997 Financial Capability Assessment document as a means to compare the affordability factors among communities. This assessment tool only recognized CWA-related projects and used a citywide MHI to determine a community's affordability percentage against a low, medium and high burden scale. The 2014 FCA Framework recognizes that SDWA obligations are an important consideration in determining integrated planning schedules and a community's financial capability. Even with this much improved assessment tool, it assumes each customer's financial burden is represented fairly by using an average cost per household across all communities. Using this assessment model would not take into account the City's disproportionate income distribution.

Between the 2000 Census and 2013 Census estimate, the City's population declined by 4.4 percent and its households by 6.3 percent, and its MHI stayed relatively unchanged. The City's percentage of low-income households is two times the national average and the percentage of its higher-income households is half the national average. Against this difficult economic picture the City has had to raise its water, sewer and stormwater bills to the point that rates have quadrupled since 1998 and under the Consent Decree, rates have increased more than the rate of inflation. The quadrupling of water, sewer and stormwater bills over the past 17 years has had a devastating impact on the City's very large population of low-income residents. Even with an end date of 2034 as proposed by the City, by the end of the Consent Decree more than 98,000 households, constituting over 40 percent of the City's population, would be unable to afford their water, sewer and stormwater bills.

The City took the additional step of utilizing the MWH WARi model to analyze affordability at the Census tract level using the full income distribution data rather than MHI for each tract as well as a calculated average water and sewer bill based on actual billings. Using this detailed data, the model was able to demonstrate that the EPA "high" burden standard of 4.5 percent as it relates to Baltimore's population is skewed and should be set at 4.13 percent for Baltimore. This seemingly modest percentage difference has a direct impact on the City's financial capacity. The WARi analysis shows that 40 percent of households' average bill will exceed the high burden threshold over time.

APPENDIX A. FINANCIAL CAPABAILITY ASSESSMENT USING 1997 EPA GUIDANCE

Phase 1 Assessment: The Residential Indicator

The EPA's 1997 Guidance ("EPA Guidance") provides recommendations on how to conduct a financial capability analysis. This section presents the results for Phase 1 of that analysis, the calculation of the Residential Indicator, including replicas of the specific worksheet/forms contained in the EPA Guidance. The intention of the Residential Indicator is to measure "…financial impact of the current and proposed WWT ['wastewater treatment' in the broader sense of 'wastewater management'] and CSO controls on residential users."

The cost value of the wastewater system is divided by the number of contributing households to determine Cost per Household (CPH). Once this figure is determined, the CPH is divided by MHI to determine the Residential Indicator (CPH as a percentage of MHI).

If the CPH is less than 1 percent of MHI, then this cost related factor is considered a low Financial Impact value. If the CPH is between 1 and 2 percent of MHI, then this factor is considered a mid-range Financial Impact value. If CPH is more than 2 percent of MHI, then this factor is considered a high Financial Impact value. The EPA Guidance is not clear with respect to applying these criteria to the Integrated Planning Framework, especially in cases like Baltimore's where the Integrated Plan comprehensively includes both water and wastewater (and stormwater) investments to address the CWA and SDWA requirements. Where a 2 percent value has been used and documented in cases involving CWA compliance, a value of 2.5 percent appears to apply to SDWA cases, a figure that appears applicable to smaller municipal drinking water systems.[12] The City's research into these values has not provided any clear documentation as to why the values are different, where the values originated, or the rationale for establishing them as appropriate benchmarks for measuring the residential indicator in the first place.

The City has made a good-faith attempt to modify EPA Guidance with respect to the Residential Indicator to fit its Integrated Plan which includes both CWA and SDWA considerations. Table A.1 shows EPA's Residential Indicator criteria and the modifications proposed by the City for application here.

Table A.1. Phase 1 Criteria

Financial Impact	EPA Guidance	Baltimore-Proposed IP Modification
Low	Less than 1.0 percent of MHI	Less than 2.0 percent of MHI
Mid-Range	1.0 to 2.0 percent of MHI	2.0 to 4.5 percent of MHI
High	Greater than 2.0 percent of MHI	Greater than 4.5 percent of MHI

[12] U.S. Environmental Protection Agency. February 1998. *Information for States on Developing Affordability Criteria for Drinking Water*.

These financial impact ratings are used in the Financial Capability Matrix presented later in this section. The Financial Capability Matrix brings together the Residential Indicator with the six Permittee Financial Capability Indicators developed in the Phase 2 Evaluation. The first step of the Phase 1 Evaluation, then, is to determine CPH.

The Cost per Household

The CPH evaluation considers existing and projected costs of the Integrated Plan on a per-household basis. The ratio of residential wastewater flow to total flow is used to estimate residential share of total costs. The residential share of costs divided by number of households yields the CPH, in accordance with EPA Guidance protocol. A summary of these calculations is provided below at Table A.2.

An important caveat regarding Table A.2 is the lack of estimated annual O&M costs on Line 103. Accurate estimates of projected O&M costs for future infrastructure facilities are not yet available, but are expected to be significant. For example, for the Back River Wastewater Treatment Plant ("BRWWTP") Headworks Project, which includes an influent pumping station, screening and grit facilities and storage basins, preliminary annual O&M cost estimates include $1,100,000 in energy costs, $850,000 in solids disposal costs, $850,000 in personnel costs and between $500,000 and $1,000,000 in maintenance costs (the wide range depends on the amount of worked performed with in-house resources versus contracted resources), for a total of between $3.3 and $3.35 million per year.

Table A.2. Costs Per Household Determination for Each Utility Service and In Total

Row	Item	Unit	Water	Sewer	Stormwater	Total
Current Costs						
100	Annual O&M Costs (Excluding Depreciation)	($s)	$128,200,021	$150,136,766	$15,309,051	$293,645,838
101	Annual Capital and Debt Service	($s)	$52,604,372	$68,200,549	$3,639,742	$124,444,663
102	Subtotal	($s)	$180,804,393	$218,337,315	$18,948,793	$418,090,501
Projected Costs						
103	Estimated Annual O&M Costs	($s)	$0	$0	$0	$0
104	Estimated Annual Debt Service and Capital	($s)	$155,282,520	$87,743,306	$33,475,105	$276,500,931
105	Subtotal	($s)	$155,282,520	$87,743,306	$33,475,105	$276,500,931
106	Total Current and Projected Costs	($s)	$336,086,913	$306,080,621	$52,423,898	$694,591,432
107	Residential share of total costs	($s)	56.4%	56.4%	68.4%	
108	Total number of Households in Service Area		241,455	241,455	241,455	
109	Cost Per Household	($s)	$785	$715	$148	$1,648

The following provides additional information about the various rows of information in Table A.2.

Row 100 These are the current annual operations and maintenance (O&M) costs for the City's drinking water, wastewater and stormwater systems.

Row 101 These are the current annual debt service obligations, in total, for each of the utilities.

Row 103 The projected O&M costs for the facilities and assets anticipated by the Integrated Plan in this analysis is zero due to the lack of reasonable current estimates. Row 103 is a placeholder for the insertion of such estimates when available. Inclusion of additional O&M costs for the proposed facilities, as well as to implement the proposed collection system cleaning cycles being negotiated in the Consent Decree, have the potential to change the overall burden estimate.

Row 104 The City anticipates engaging in significant new bond financing in order to fund the Integrated Plan resulting in $276.5 million in total additional debt service based on the City's financial plans. Approximately 38 percent of the Integrated Plan will be financed with revenue bonds with an assumed term length of 30 years in each case and with interest rates between 4.5 and 5.5 percent.

Row 107 The residential share of the total costs is determined from analysis of the volumes of service used by the residential customers as a percentage of total volume of services provided. In the case of stormwater service, the residential share was determined based on the percentage of revenue currently billed to residential customers as a percentage of total stormwater revenue. In both cases, the flow and revenue values were measured as of 2014.

Row 108 The total number of households is derived from the U.S. Census Bureau's American Community Survey results for 2013.

Row 109 The CPH is determined for the drinking water, wastewater and stormwater systems, and for all utilities in total by multiplying the values on Row 106 by the percentage on Row 107 and then dividing by the number of households on Row 108. The cost shown is an annual amount.

The Residential Indicator

The Residential Indicator computation divides CPH, as determined above, by MHI. This is shown in Table A.3.

Table A.3. Residential Indicators for Each Utility Service and in Total

Row	Item	Unit	Water	Sewer	Stormwater	Total
Median Household Income						
201	MHI in 2013	($s)	$41,385	$41,385	$41,385	$41,385
202	CPI Adjustment Factor	(%)	1.031	1.031	1.031	1.031
203	Adjusted MHI	($s)	$42,660	$42,660	$42,660	$42,660
204	Annual Cost per Household	($s)	$785	$715	$148	$1,648
205	Residential Indicator					
	CPH as a percentage of adjusted MHI	(%)	1.84%	1.68%	0.35%	3.86%

The following provides additional information about the various rows of information in Table A.3.

Row 201 This is the median household income reported for the Baltimore (city) statistical area measured by the U.S. Census Bureau. This row is the MHI reported in the American Community Survey for its 2013 estimate.

Row 202 The 2013 estimated MHI in Row 201 is adjusted by the average actual inflation rate as observed over the past five years in order to index the value to 2015, the base year of these analyses. CPI-U inflation rates varied from -0.1 to 2.9 percent between 2011 and 2015; the average annual rate was 1.58 percent. The adjustment factor used is the squared term, $(1+ 1.58\%)^2$, to account for compounded inflation for two periods between 2013 and 2015.

Row 203 This row shows the indexed MHI applicable for 2015 after applying the CPI adjustment factor from Row 202 to the 2013 estimate.

Row 204 The annual cost per household is taken from Table A.2**.**

Row 205 The residential indicator is the quotient from dividing Row 204 by Row 203.

The results as shown in Table A.3 produces a total value above 2 percent, and individual values for the water and sewer utilities above 1 percent. This suggests that the Phase 2 assessment should be completed in accordance with EPA Guidance.

Phase 2 Assessment: Permittee Financial Capability Indicators

EPA Guidance calls for six Permittee Financial Capability Indicators. There are two debt indicators, two socioeconomic indicators, and two financial management indicators.

Debt Indicators	Socioeconomic Indicators	Financial Management Indicators
Bond ratings	Unemployment rate	Property tax revenue collection rate
Overall net debt as percent of full market property value	Median Household Income	Property tax revenues as percent of full market property value

Table A.4 shows the EPA's Financial Capability criteria used to evaluate the six Indicators. Indicators are shown in the left-most column. Each of the Permittee's financial indicators will be assessed to be "Strong," "Mid-Range" or "Weak" depending on the Permittee's actual data compared with criteria shown in the cells of the table.

Table A.4. EPA Financial Capability Indicator Criteria and Benchmarks

Indicator	*Strong*	*Mid-Range*	*Weak*
Bond Rating	AAA-A (S&P) or Aaa-A (MIS)	BBB (S&P) or Baa (MIS)	BB-D (S&P) or Ba-C (MIS)
Net Debt/Property Value	Below 2%	2% - 5%	Above 5%
Unemployment Rate	>1% below National Ave.	±1% of National Ave.	>1% above National Ave.
Median Household Income	>25% above adj. Nat'l MHI	±25% of adj. Nat'l MHI	>25% below adj. Nat'l MHI
Prop. Tax/Property Value	Below 2%	2% - 4%	Above 4%
Prop. Tax Collection Rate	Above 98%	94% - 98%	Below 94%

Debt Indicators

The two Debt Indicators are Bond Ratings and Net Debt. The EPA Guidance states that these indicators "…were selected to assess current debt burden conditions and ability to issue new debt". Ratings and total amount of outstanding debt are important parameters associated with undertaking additional debt. However, they are not the only parameters for determination of sustainable financial affordability, and in many cases may not be the most important parameters. There are a number of alternatives for structuring long-term debt for large capital projects. Typically, wastewater and wastewater-related system capital projects are financed by the sale of revenue bonds or by undertaking state sponsored loans, both of which are secured by the promises that the borrower will continue to produce ample direct operating revenue (sewer user charges) in the future.

Because revenue production is the critical factor in the ability of an issuer to service revenue bond debt (i.e., annually pay principal and interest on the bonds), the history and reasonable forecast of net revenue production is the key factor used by rating agencies to evaluate credit worthiness – that is, to assess ability to undertake additional debt and the cost of that debt. The

EPA Guidance recognizes the distinction between revenue bonds and GO bonds in the discussion of the "Bond Rating" financial capability indicator.

Table A.5. Bond Ratings Worksheet [EPA Rating = "Strong"]

Row	Item	Unit	Value
301	Most Recent General Obligation Bond Rating		Aa2
	Date		Jan, 2013
	Rating Agency		Moody's
302	Most Recent Revenue Bond Rating		Aa2
	Date		Nov, 2014
	Rating Agency		Moody's
303	Summary Bond Rating		Aa2

The second of the "Debt Indicators" is "Overall Net Debt as a Percent of Full Market Property Value." The EPA Guidance provides, "Overall net debt is debt repaid by property taxes in the permittee's service area." Net debt is interesting as an indicator of the overall stress of community debt on constituents, but has little to do with the capability to issue revenue bonds for additional infrastructure financings. The important parameter for the assessment of projected financial capability to undertake project financings is how net revenues are forecast to produce sufficient revenue to service the debt, and how many and to what levels will rate increases are needed to achieve sufficient revenues. In rare cases, debt is limited by statute or ordinance; more frequently, the issuance of bonds is limited by the political will to enact rate increases that are deemed unaffordable. In Baltimore, an ordinance would need to be adopted to raise the debt ceiling for the water and wastewater utilities.

Table A.6. Net Debt [EPA Rating = "Mid-Range"]

Row	Item	Unit	Value
401	Direct Net Debt	$	721,423,000
402	Debt of Overlapping Entities	$	$0
403	Overall Net Debt	$	$721,423,000
404	Market Value of Property	$	36,232,091,000
405	Overall Net Debt as Percent of Market Property Value	%	2.0

Because the Net Debt indicator is a ratio of debt to property value, and because property value is the basis for ad valorem taxation that is used to pay general obligation debt, the EPA Guidance suggests the total debt figure to be net of revenue bond debt, as that form of debt is not paid by property taxes. As of the last available reporting period, the City's 2013 Comprehensive Annual Financial Report, general obligation debt consisted of $569.1 million in general obligation bonds; $114.4 million in special obligation bonds; $36.5 million in long-term federal financing vehicles; and $1.4 million in financing obligations with the State of Maryland.

The City's rating falls into the "Mid-Range" category for this indicator because the net debt as a percentage of property values is between 2 and 4 percent.

Socioeconomic Indicators

The two Socioeconomic Indicators are Unemployment and Household Income, both of which are readily measured from US Census Bureau and Bureau of Labor Statistics data.

The unemployment rate for the City and the United States[13] for the year 2014 were obtained from the Bureau of Labor Statistics. Because unemployment in the City is greater than 1 percent above the national average, this ratio indicates "Weak" Financial Capability, according to the criteria of Table A.4. The unemployment indicator is determined as shown in Table A.7.

Table A.7. Unemployment Worksheet [EPA Rating = "Weak"]

Row	Item	Value
501	Unemployment Rate	10.2%
	Source	*City of Baltimore, BLS*
502	Unemployment Rate - County	n/a
	Source	*n/a*
503	Average National Unemployment Rate	7.4%
	Source	*BLS*

The Household Income Indicator is related to the Residential Indicator in that both incorporate MHI. While the Residential Indicator compares MHI to cost per household, here the Household Income Indicator compares local MHI to national MHI, as a measurement of relative wealth or poverty.

As discussed previously, the MHI for the City's service area adjusted to 2013 was $41,385. The CPI based adjustment of MHI to the 2015 year is $42,660 is shown in Table A.8**.**

The U.S. Census Bureau reports that the median income of households in the United States in 2013 was $52,250.[14] Applying the same CPI based adjustment to the national MHI to estimate 2015 MHI yields an adjusted figure of $53,859 as shown.

Because local MHI is within 25 percent of the national MHI, according to EPA criteria included on Table A.4, this ratio indicates "Mid-Range" Financial Capability.

[13] Bureau of Labor Statistics. 2014 Annual Unemployment Rate [http://www.bls.gov/]
[14] U.S. Census Bureau. 2013 American Community Survey 5 Year Estimate, Table B19013.

Table A.8. Household Income Worksheet [EPA Rating = "Mid-Range"]

Row	Item	Unit	Value
601	Median Household Income (Adjusted to 2015)	$	42,660
	Source		*2013 5-Year ACS*
602	Census Year National MHI	$	52,250
603	MHI Adjustment Factor		1.031
604	Adjusted National MHI	$	53,859
	Source		*2013 5-Year ACS*

Financial Management Indicators

The two Financial Management Indicators are property tax revenues and property tax collection efficiency. Although the City's utilities are enterprise funded and collection of property taxes is essentially irrelevant to the utilities ability to pay, property value and property tax revenue are included in Table A.9 in accordance with EPA Guidance. As shown in Table A.9, the property value and property tax revenue results in a tax revenue as percentage of total value of 2 percent. This indicates a "Mid-Range" financial capability for this financial indicator.

Table A.9. Property Tax Revenues Worksheet [EPA Rating = "Mid-Range"]

Row	Item	Unit	Value
701	Full Market Value of Real Property	$	36,232,091,000
702	Property Tax Revenue	$	732,467,000
703	Property Tax Revenue as Percentage of Value		2.0
	Source		

The last of the EPA Guidance financial capability indicators is the property tax revenue collection rate. Computation of this indicator is shown in Table A.10.

Data used for this indicator are derived from the City's 2013 CAFR, as were the data for the previous indicator as shown in Table A.9. Because Baltimore's collections are between 94 and 98 percent of the amount levied, this ratio indicates "Mid-Range" Financial Capability, according to the criteria of Table A.4.

Table A.10. Tax Collection Efficiency Worksheet [EPA Rating = "Mid-Range"]

Row	Item	Unit	Value
801	Property Tax Revenue Collected	$	732,467,000
802	Property Taxes Levied	$	763,106,000
803	Property Tax Revenue Collection Rate	%	95.98

Summary of Phase 2 Financial Capability Indicators

The Indicator values and scores of the six Financial Capability Indicators are compiled in Table A.11. The EPA Guidance provides that for each "Weak" financial capability indicator shall be assigned a numeric value of "1". Similarly, "Mid-Range" indicators are assigned "2" and "Strong" indicators are assigned "3." Baltimore scored a "1" on one of the indicators, a "2" on four of the indicators, and a "3" on one of the indicators. The simple arithmetic average of the six indicators is 2.0.

Table A.11. Summary of Financial Capability Indicators

Row	Item	Value	Score
901	Bond Rating	Aa2	3
902	Net Debt	2.0%	2
903	Unemployment Rate compared with National Average	2.8%	1
904	MHI compared with National Average	-20.8%	2
905	Property Tax Revenue Percent of Property Value	2.0%	2
906	Property Tax Revenue Collection Rate	96.0%	2
907	Indicator Score		**2.00**

Summary of Baltimore's Financial Capability Assessment

Combining the Phase 1 and Phase 2 indicators produces a total FCA score based on the matrix below. Baltimore's residential indicator was 3.86 percent, thus falling into the mid-range along the top row of the matrix. The combined score from the Permittee Financial Capability Indicators was 2.0, also indicating a mid-range result along the left column of the matrix. The combination of a mid-range score for both the residential indicator and the financial capability indicators is a "medium burden" under the EPA Guidance.

Therefore, as illustrated in Table A.12**,** Baltimore's Integrated Plan results in a "medium burden". For the various reasons delineated in the body of this Affordability Analysis, the EPA Guidance medium burden results fail to take the City's affordability issues into consideration. The WARi analysis is a more appropriate analysis than median household income. The City's unemployment is more than one percent above current national unemployment. The City's household income distribution is skewed with more low-income households and fewer high-income households compared to the national household income distribution. Reliance on the EPA Guidance methodology masks these affordability impacts.

Table A.12. Financial Capability Score Summary

Permittee Financial Capability Indicators Score	Residential Indicator		
	Low (Below 2.0%)	Mid-Range (Between 2.0 & 4.5%)	High (Greater than 4.5%)
Weak (Below 1.5)	MEDIUM BURDEN	HIGH BURDEN	HIGH BURDEN
Mid-Range (Between 1.5 & 2.5)	LOW BURDEN	**MEDIUM BURDEN**	HIGH BURDEN
Strong (Above 2.5)	LOW BURDEN	LOW BURDEN	MEDIUM BURDEN